



Calhoun: The NPS Institutional Archive DSpace Repository

Theses and Dissertations

1. Thesis and Dissertation Collection, all items

1989

An analysis of unassigned direct material at naval shipyards.

Rohrbach, Mark D.

Monterey, California. Naval Postgraduate School

<http://hdl.handle.net/10945/26878>

Downloaded from NPS Archive: Calhoun



<http://www.nps.edu/library>

Calhoun is the Naval Postgraduate School's public access digital repository for research materials and institutional publications created by the NPS community.

Calhoun is named for Professor of Mathematics Guy K. Calhoun, NPS's first appointed -- and published -- scholarly author.

Dudley Knox Library / Naval Postgraduate School
411 Dyer Road / 1 University Circle
Monterey, California USA 93943



NAVAL POSTGRADUATE SCHOOL

Monterey, California



THEESIS

R6873

AN ANALYSIS OF UNASSIGNED DIRECT
MATERIAL AT NAVAL SHIPYARDS

by

Mark D. Rohrbach

December 1989

Thesis Co-advisors: Alan W. McMasters
Glenn Eberling

Approved for public release; distribution is unlimited

T247303

REPORT DOCUMENTATION PAGE

1a REPORT SECURITY CLASSIFICATION UNCLASSIFIED		1b RESTRICTIVE MARKINGS					
2a SECURITY CLASSIFICATION AUTHORITY		3 DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution is unlimited					
2b DECLASSIFICATION/DOWNGRADING SCHEDULE		4 PERFORMING ORGANIZATION REPORT NUMBER(S)					
5 MONITORING ORGANIZATION REPORT NUMBER(S)		6a NAME OF PERFORMING ORGANIZATION Naval Postgraduate School		6b OFFICE SYMBOL (If applicable) Code 36	7a NAME OF MONITORING ORGANIZATION Naval Postgraduate School		
7b ADDRESS (City, State, and ZIP Code) Monterey, California 93943-5000		8a NAME OF FUNDING/SPONSORING ORGANIZATION		8b OFFICE SYMBOL (If applicable)	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER		
8c. ADDRESS (City, State, and ZIP Code)		10 SOURCE OF FUNDING NUMBERS		PROGRAM ELEMENT NO	PROJECT NO	TASK NO	WORK UNIT ACCESSION NO
11 TITLE (Include Security Classification) AN ANALYSIS OF UNASSIGNED DIRECT MATERIAL AT NAVAL SHIPYARDS							
12 PERSONAL AUTHOR(S) Rohrbach, Mark D.							
13a TYPE OF REPORT Master's Thesis	13b TIME COVERED FROM _____ TO _____		14 DATE OF REPORT (Year, Month, Day) 1989, December		15 PAGE COUNT 64		
16 SUPPLEMENTARY NOTATION The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.							
17 COSATI CODES		18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number) Inventory Control; Shipyards					
19 ABSTRACT (Continue on reverse if necessary and identify by block number) Unassigned Direct Material (UDM) accounts at naval shipyards, which consist of surplus material from the overhaul process, continue to grow at a rapid pace (42% per year since 1985). Minimal return on material placed in these accounts coupled with a shrinking defense budget has forced the Navy to take a closer look at inventory methods at naval shipyards. The author, in an effort to propose potential solutions to the growing UDM account problem reviewed the current policies and procedures governing inventory control/inventory management at naval shipyards. Extensive interviews were conducted with personnel at NAVSEA, SPCC, and all eight naval shipyards with emphasis at Mare Island Naval Shipyard. The current policy outlined by NAVSEA needs to be better implemented. This coupled with a two-pronged effort aimed at creating a historical usage database to							
20 DISTRIBUTION/AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT <input type="checkbox"/> DTIC USERS			21 ABSTRACT SECURITY CLASSIFICATION Unclassified				
22a NAME OF RESPONSIBLE INDIVIDUAL Prof. Alan W. McMasters			22b TELEPHONE (Include Area Code) (408) 646-2678		22c OFFICE SYMBOL Code 54Mg		

#19 - ABSTRACT - (CONTINUED)

better identify material requirements and increasing the visibility of UDM should assist in reducing the amount of this surplus material.

An Analysis of Unassigned Direct
Material at Naval Shipyards

by

Mark D. Rohrbach
Lieutenant, United States Navy
B.S., United States Naval Academy, 1983

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
December 1989

ABSTRACT

Unassigned Direct Material (UDM) accounts at naval shipyards, which consist of surplus material from the overhaul process, continue to grow at a rapid pace (42% per year since 1985). Minimal return on material placed in these accounts coupled with a shrinking defense budget has forced the Navy to take a closer look at inventory methods at naval shipyards. The author, in an effort to propose potential solutions to the growing UDM account problem reviewed the current policies and procedures governing inventory control/inventory management at naval shipyards. Extensive interviews were conducted with personnel at NAVSEA, SPCC, and all eight naval shipyards with emphasis at Mare Island Naval Shipyard. The current policy outlined by NAVSEA needs to be better implemented. This coupled with a two-pronged effort aimed at creating a historical usage database to better identify material requirements and increasing the visibility of UDM should assist in reducing the amount of this surplus material.

TABLE OF CONTENTS

I.	INTRODUCTION -----	1
	A. NAVAL SHIPYARD MISSION -----	2
	B. SHIPYARD MATERIAL PLANNING -----	3
	C. NAVY INDUSTRIAL FUND -----	6
	D. OBJECTIVES OF THIS STUDY -----	8
	E. SCOPE AND LIMITATIONS OF THIS STUDY -----	8
	F. METHODOLOGY -----	9
	G. ORGANIZATION OF THIS STUDY -----	10
II.	BACKGROUND -----	11
	A. DIRECT MATERIAL INVENTORY -----	13
	B. UNASSIGNED DIRECT MATERIAL INVENTORY -----	15
	C. CURRENT UDM ACCOUNTS -----	17
	D. CURRENT NAVSEA GUIDELINES -----	19
	E. SHIPYARD MANAGEMENT INFORMATION SYSTEM -----	21
	F. SUMMARY -----	26
III.	PREVIOUS STUDIES -----	28
	A. COOPERS & LYBRAND STUDY -----	28
	B. GOVERNMENT STUDIES -----	32
	C. SUMMARY -----	37
IV.	DISCUSSION AND ANALYSIS -----	39
	A. DIRECT MATERIAL INVENTORY -----	39
	B. UNASSIGNED DIRECT MATERIAL INVENTORY -----	41

C. SHIPYARD MANAGEMENT INFORMATION SYSTEM -----	45
D. SUMMARY -----	46
V. SUMMARY AND RECOMMENDATIONS -----	47
A. SUMMARY -----	47
B. RECOMMENDATIONS -----	48
C. FUTURE RESEARCH -----	52
APPENDIX: LIST OF ACRONYMS -----	53
LIST OF REFERENCES -----	54
BIBLIOGRAPHY -----	56
INITIAL DISTRIBUTION LIST -----	57

I. INTRODUCTION

The catalyst for this research is constantly increasing unassigned direct material (UDM) inventory accounts at naval shipyards. This increase is caused by more material being ordered for an overhaul or limited availability than is ultimately used. In an attempt to control the monetary size of these accounts and to reclaim limited physical storage space, the material is returned to the supply system or sent to disposal. The result is a financial loss to the shipyard. This reduces the revolving fund the shipyard operates under and will ultimately necessitate additional funding from the Navy.

Several problems surround unassigned direct material. Foremost is that naval shipyards must operate within a restricted budget. Thus, any program such as UDM which could potentially be improved and save the shipyards money is a high priority. Also, the Navy has a limited number of ships and submarines to support the nation's Maritime Strategy. These force constraints create pressure on the shipyards to strictly adhere to an overhaul turn-around time outlined by the Commander Naval Sea Systems Command (NAVSEA). Slippage of this timetable could result in performing the same operations with a reduced number of vessels. Obviously, if a ship/submarine remains in overhaul

beyond the desired time other vessels must delay their overhauls and absorb additional operations. As a consequence, the emphasis at shipyards is usually on expediting overhaul production at the expense of cost overruns. The subsequent impact on material accounts is a disregard for expense as extra material is ordered to prevent production delays.

A. NAVAL SHIPYARD MISSION

NAVSEA, having the overall responsibility for the maintenance of Navy ships, has assigned the following functions to the eight naval shipyards:

1. Providing logistic support to activities and units of the Operating Forces of the U.S. Navy and naval shore (field) activities, as assigned by competent authority.
2. Performing authorized shipwork in connection with the construction, conversion, overhaul, repair, alteration, activation, inactivation and outfitting of naval ships and service craft.
3. Performing authorized repairables work in connection with repair, restoration, refit, refurbishment and overhaul of systems, equipments, components and modules as scheduled.
4. Designing naval ships when so designated.
5. Operating as a planning yard for ship alterations and preparing allowance lists for ships under construction and conversion in accordance with instructions issued by the Naval Sea Systems Command.
6. Performing research, development, test and evaluation work, as assigned.
7. Serving as a stock point for designated material, as assigned.
8. Providing accounting, civilian payroll, savings bonds, public works, industrial relations, medical, dental,

berthing, messing, fire prevention and fire protection, security and other services to naval shore (field) activities and other government agencies, as assigned.

9. Performing manufacturing, as assigned.

10. Accomplishing shore-electronics work; as requested by the Space and Warfare Systems Command (SPAWARS).

11. Preparing and maintaining development, logistic support, disaster control and other plans, as assigned.

12. Performing work for other U.S. Government Departments, private parties and foreign governments, as directed by competent authority. [Ref. 1:pp. 3-4]

The extent to which the above functions are applicable to a specific shipyard is dependent upon that shipyard's capabilities. For example, Philadelphia and Long Beach Naval Shipyards have no nuclear maintenance capability.

Overhaul and repair is also conducted at private shipyards. The Navy monitors the work at these shipyards to ensure the requisite quality of repair and contract compliance. An in-depth look at private shipyard operations is beyond the scope of this study.

B. SHIPYARD MATERIAL PLANNING

Because the emphasis of this study will be on inventory control/inventory management, only those portions of the organization are discussed. Specifically, these are the supply department and the planning department.

NAVSEA issues a directive outlining the schedule of ship overhauls tentatively planned for shipyards 24 months prior to the start of these overhauls. Once these assignments are made, a ship's Type Commander (for example, Commander

Submarine Force Pacific (COMSUBPAC)) begins communicating to the planning department of the assigned shipyard the specific work requirements desired for the overhaul.

The result of this communication is a work package defining all work to be accomplished during an overhaul. This work package is further broken down into job orders which define in detail the work to be accomplished on specific systems within the ship. Within these job orders are key events or key operations (key-ops) defined by shipyard management to be critical events in the overhaul. There can be several key-ops within one job order. Often these key-ops are the "critical path" of the project's network of activities requiring completion.

Once the scope of work has been defined, the planners and estimators attached to the planning department begin evaluating the material and man-hours required to complete the defined work. This job order system is also a method of documenting the maintenance cost associated with each system repair. The material requirements for each job order are outlined on a job material list (JML).

The JML's are then researched to ensure the material outlined meets all the technical requirements and dimension specifications for the system in which it will be installed. These JML's are subsequently submitted to the supply department for material requisitioning. The supply department is tasked with ordering, receiving, storing and

issuing the material. Ultimately the material is issued to production shops who are the end users.

Material is broken down into two categories, standard and non-standard. Standard stock can come from two agencies. The Ships Parts Control Center (SPCC) provides systems and components unique to the Navy. The Defense Logistics Agency (DLA) supplies materials common to all Department of Defense agencies. SPCC- and DLA-furnished material is processed and distributed by the regional Naval Supply Centers that support individual shipyards. Non-standard stock is material not carried by the Navy Stock System or by DLA.

The goal is to receive all material in time to support the industrial process. There are several methods used to do this. First, on the JML there is a required delivery date. This is a "drop dead date" by which the material must be received to support work. Also, a priority is listed on the requisition which tells the organization shipping the material how urgently the material is needed. Finally, each supply department has a code that handles nothing but expediting. Their sole purpose is to attempt to speed up the delivery process or search for alternate sources for the material if it becomes apparent the material will not arrive in time to support the industrial process.

An important interface is that between the estimators of the planning department and the shop planners who are

associated with the production shops. Because of their "hands on" experience, shop planners may identify material requirements not understood or foreseen by the estimators. Also, they may realize that historical usage does not justify all the material outlined on a technical repair standard (TRS), thus avoiding excess material at the completion of the overhaul.

C. NAVY INDUSTRIAL FUND

In these times of limited budgets, it is important to understand how the man-hours and material discussed in the previous section are funded. The Navy Industrial Fund was established to assist certain activities to function in a more efficient manner. The reasoning behind this concept was to free these activities of the worry associated with total dependence on cyclic annual appropriations.

NIF activities operate on a "revolving fund" basis. This means they are initially appropriated an amount of working capital (called NIF corpus) which is used to finance their operations from the time the work begins until payment is received from the customer. [Ref. 2:p. 13]

To qualify as a NIF activity an organization's operations must have a buyer-seller relationship and produce their goods or provide services for more than one customer. While providing services, the NIF activity must comply with most of the following Department of Defense (DOD) objectives:

Provide efficient modern management tools similar to those used by private enterprises; provide incentives for cost control and estimating required by the buyer-seller contractual relationship; financial planning dependent on reimbursements received; coordinate labor force and inventories with work load; production scheduling and control, procurement and inventory control, budgeting and cost control; use cost standards; require customers to budget and account for all the goods and services ordered; provide bills showing goods and services performed; enable customer to budget on an end-product basis; predetermine and standardize budgets; and improve customer's planning and scheduling. [Ref. 2:p. 19]

All eight naval shipyards are NIF activities. They accomplish many of the above objectives with the job order costing system. Within this system, the customer order acceptance record (COAR) is the basis for accumulating costs billed to a customer. The COAR is a financial management tool generated concurrently with the job order by planners specifying the following:

- (1) Services to be rendered and a required delivery schedule,
- (2) The quantity of funds authorized for the project (i.e., direct labor man-hours, material, etc.), and
- (3) A detailed breakdown of cost by item in the final billing. [Ref. 3:p. J-7]

In summary, the NIF concept has three major features. First, a contractual relationship is required between the NIF activity and the customer. This forces the NIF activity to better define the task and accurately estimate the associated costs. Second, the job order costing system associates costs with a specific job. This should allow the costs related to a task to be better managed. Finally, the

revolving NIF corpus allows the activities to be freed from the annual appropriations cycle.

A shrinking defense budget has forced shipyards to take a closer look at costs and propose cost cutting measures that will allow them to continue to operate within their corpus. Increasing efficiency to reduce costs is in the forefront of every shipyard comptroller's mind.

D. OBJECTIVES OF THIS STUDY

This study focuses on methods of reducing the costs associated with surplus material resulting from an overhaul (UDM). Specifically, how can UDM accounts be reduced thereby reducing the shrinkage rate of the NIF corpus? Another objective of this study is to outline the management tools available to shipyard managers to control/limit UDM inventories.

E. SCOPE AND LIMITATIONS OF THIS STUDY

The focus of this study is only on the UDM segment of naval shipyards' inventory accounts. The resulting recommendations are aimed at reducing the dollar value of material that is placed into the UDM inventory after each overhaul and increasing the usage of material from the UDM account prior to excessing the material. By reducing the dollars lost to inventory that is not used, the NIF corpus will be buoyed and hence less susceptible to the annual appropriations cycle.

The study is concentrated on the UDM inventory control/management specifically at Mare Island Naval Shipyard. Due to time and monetary constraints, an evaluation of the other seven naval shipyards' UDM accounts will be very limited. This study will not attempt to evaluate DOD inventory control systems.

F. METHODOLOGY

Reports concerning inventory control/inventory management at naval shipyards were reviewed. This material was supplemented with literature provided by the Naval Postgraduate School faculty, the Knox Library at the Naval Postgraduate School, the U.S. General Accounting Office, the Naval Audit Service, Naval Sea Systems Command and Mare Island Naval Shipyard.

This literature was reviewed to gain an understanding of shipyard operations and current inventory management policies. This information was supplemented by personal observation of inventory management at Mare Island Naval Shipyard. Questions arising during the study were answered via telephone interviews with personnel at all eight naval shipyards and at NAVSEA.

Problems outlined by previous studies were discussed with shipyard personnel to determine their applicability. Potential solutions were also discussed to justify their feasibility.

G. ORGANIZATION OF THIS STUDY

Chapter II addresses the material management philosophy in naval shipyards. Included are the process by which inventory accounts are created and managed throughout a ship's overhaul.

Chapter III addresses the results of independent studies done by the U.S. General Accounting Office (GAO) and the accounting firm of Coopers & Lybrand. Although several of these studies addressed naval shipyards as a whole, this chapter focuses on the inventory control/inventory management segment of these studies at naval shipyards.

Chapter IV includes discussion of potential and actual problems with the naval shipyard inventory process revealed by this study and the financial impact of these problems.

The final chapter summarizes the findings of this study and makes specific recommendations with respect to naval shipyard inventory control procedures concerning UDM accounts. Recommendations for future research are also included.

II. BACKGROUND

Several classes of inventory exist in the shipyard. These classes include Direct Material Inventory (DMI), Unassigned Direct Material Inventory (UDM), and Shop Stores Inventory (SS). This study will not consider the creation, management or disposition of the shop stores inventory.

The creation of an inventory account for a specific overhaul begins several years prior to the actual overhaul commencement date. Extensive preplanning is necessary to ensure long lead-time items are available prior to commencing work associated with these components. Most of the long lead-time high dollar value items are ordered by NAVSEA and shipped prior to the overhaul start date. Once the shipyard receives these items, they are assigned a project number (to correlate material to project) and stored in a warehouse until needed.

Other material requirements are identified by planners. Each "job" is defined as to the scope of work to be accomplished on a particular system. The job planner and personnel from the lead shop identified on the job order physically inspect the system to be worked on to identify material requirements and potential problems. From this job description and personal observations, a job material list (JML) is generated which identifies all material required to

complete the associated task. Formally recorded historical-use data is not currently available to the planners. Therefore, the planners use technical repair standards (TRS), allowance parts lists (APL), direct observations, and personal experience to generate the JML's.

The JML's are then sent to the supply department for ordering. Once the supply department receives the JML, it is mandated by current shipyard policy to process any requisition within one day of receipt. This stringent requirement was established to ensure the material is not delayed by the administrative process. The date when the material is needed is expressed by the required delivery date (RDD) on the JML. This required delivery date is the planners' best estimate as to when the job will begin. Often the shipyard uses the overhaul commencement date as the RDD. Each item when received will become part of that project's DMI account. It will be identifiable by the project number and the job order number.

No consideration is given to the availability or location of material when processing the requisition. For example, if Mare Island needs four gaskets and Naval Supply Center (NSC) Oakland carries 30 of these gaskets, the proximity and future availability of these parts is not considered. This material is ordered the same time as the longer lead-time, less-available material. The consequences of this policy are that the material could get shipped to

Mare Island rapidly. This shifts the responsibility of material management/inventory control from the inventory control point to the shipyard and increases the latter's material storage and management costs.

A. DIRECT MATERIAL INVENTORY

Before looking at the UDM account policy, it is necessary to first outline the policies governing UDM's origin, the DMI account. The DMI account's purpose is to provide material for specific projects (i.e., a particular ship overhaul). Prior to ordering material as a new procurement, each JML for a job order/key-op is screened through the shipyard's assets.

Material ordered for a particular project is required to be on hand in sufficient time to prevent delaying the industrial work. Often, planners will order contingency material to supplement the core of material "required" to complete the overhaul. Contingency material for this study is defined as material that could potentially be necessary to complete a job order/key-op. Each piece of material is assigned to a job order/key-op to document an end-use requirement. Contingency material with a unit value greater than \$5000 must be approved by the customer and the planning officer. Contingency material with a unit value greater than \$2000 must be approved by the planning officer.

Once a job order/key-op is complete and closed, the material not used can be handled several ways:

- (1) Transfer to DMI category 4 material at the completion of the job order/key-op. This material is now available for use on future job orders, or
- (2) Reassign as DMI to a current job order/key-op, or
- (3) Transfer to shop stores inventory if the material was a shop stores item, or
- (4) Transfer material to the UDM account no later than 60 days after the completion of the overhaul (shelf life material and depot level repairables (DLR's) are not transferred to UDM), or
- (5) Return the material to the supply system, or
- (6) Send the material to disposal. Category 5 DMI is an administrative designation for material waiting to be excessed because it has been determined there is no future use for it.

Also, at the completion of the job order/key-op material ordered but not received will be reviewed for possible cancellation.

As an overhaul progresses, material is issued from the supply warehouses to the shops conducting the work.

Although the inventory system currently in use documents the material issued for a particular job order/key-op, it does not document material usage (the system assumes all material issued is used). Consequently, the shop performing the work could hold unused material as bench spares. This practice is strongly discouraged by shipyard management. Recently, Mare Island set up a "gold pile recovery" program to recover the bench spares held by shops. The program produced large volumes of material which were fed directly into the UDM account.

Several other problems result from holding bench spares. First, often the material documentation is lost. Therefore, without performing expensive testing that is often cost prohibitive, the material is useless. Secondly, the material is no longer visible to the inventory system. If a demand arises, a new procurement will be generated if another identical item is not held in the UDM account. Furthermore, the historical usage documentation process is inaccurate due to supplementing issued material with bench spares. Finally, if the incorrect material is used in a system (which is possible if the documentation is lost) it could result in material failure, personal injury, or in the worst case loss of the ship.

B. UNASSIGNED DIRECT MATERIAL INVENTORY

It is important to note several significant events that have effected UDM accounts in the past five years. First, in 1984 the Navy placed a freeze on the disposal of material. This freeze was lifted in 1988 but had already caused the shipyards' inventory accounts to become swollen with material that may never be used. Second, in 1984 the Navy changed its policy concerning UDM. DMI from a project used to be "rolled over" from one project to the next without being entered into the UDM account. The change mandated that once an overhaul was complete, the excess DMI be placed in the UDM account. [Ref. 4] Finally, the current policy concerning DMI and UDM was formulated in

1988. A major change to the old policy is that material need only be on hand in time to support the industrial process. Prior to 1988, the requirement had been that all material for the entire overhaul be on hand prior to the overhaul commencement date. If a change occurred during the overhaul the shipyard was often left with excess material to dispose of. Because of the disposal freeze, unused material generated because of this policy was and is still carried in UDM accounts.

The purpose of the UDM account is to control, process and issue material for future use or disposition. UDM originates from two sources:

- (1) Unused material from DMI accounts (standard and non-standard), and
- (2) Shop stores.

Material is retained in the UDM account for two years beyond the customer order acceptance record (COAR) or longer if:

- (1) A specific requirement prevails, or
- (2) NAVSEA directs, or
- (3) "Sound management" dictates retention.

Standard stock may be disposed of in the following manner:

- (1) Assigned to a job order/key-op (internal usage),
- (2) Transferred to shop stores inventory,
- (3) Returned to the supply system for credit,
- (4) Sold to other activities,

- (5) Turned into the supply system after being retained in UDM for two years, or
- (6) Disposed of/scrapped under current Navy and DOD regulations.

Non-standard material may be disposed of in the following manner:

- (1) Assigned to a job order/key-op,
- (2) Transferred to shop stores inventory,
- (3) Sold to other activities,
- (4) Transferred to Ready Resource Material Program (RRMP), or
- (5) Held in UDM account for two years and then retained in UDM account subject to current Navy and DOD disposal rules.

C. CURRENT UDM ACCOUNTS

Although Mare Island Naval Shipyard's inventory policies are the focus of this study, it is worthwhile to look at the aggregate magnitude of the problem of rising UDM inventories at all eight naval shipyards. Table 1 presents the dollar value and line item size of UDM accounts at the eight naval shipyards as of their June 1989 financial statements.

The most significant element in Table 1 is Pearl Harbor's large UDM account. Pearl Harbor has requested and has received approval from NAVSEA for an extension of the two-year excessing policy on UDM material. This is a result of the increased logistical cost associated with disposal of material due to transportation costs. Costly acquisition of emergent material that could potentially be supplied from

TABLE 1
UDM INVENTORY ACCOUNT BALANCES

<u>SHIPYARD</u>	<u>UDM \$ VALUE</u>	<u>LINE ITEMS</u>
PORPSMOUTH	9,496,829.00	7,939
NORFOLK	7,846,853.61	6,641
PHILADELPHIA	17,154,533.40	5,262
CHARLESTON	10,132,437.29	18,232
LONG BEACH	32,477,589.00	25,809
PUGET SOUND	16,809,055.64	26,707
MARE ISLAND	18,574,359.69	29,013
PEARL HARBOR	33,048,709.65	78,192
TOTAL	145,640,367.30	AVG. 24,724

their UDM inventory was cited as another reason for extending the disposal period.

If Pearl Harbor naval shipyard is excluded, the UDM accounts at naval shipyards average 17,086 line items totalling \$412,591,658. It is important to understand that this data is just a snapshot in time of the UDM accounts at the eight naval shipyards. In the near future these figures may change significantly as a consequence of recent project completions or recently excessed material.

Table 2 presents the composition of the UDM accounts with respect to standard and non-standard stock.

TABLE 2
COMPOSITION OF UDM INVENTORY

<u>SHIPYARD</u>	% STANDARD STOCK		% NON-STANDARD STOCK	
	<u>LI</u>	<u>\$</u>	<u>LI</u>	<u>\$</u>
PORPSMOUTH	74	72	26	28
NORFOLK	n.a.*	n.a.	n.a.	n.a.
PHILADELPHIA	n.a.	n.a.	n.a.	n.a.
CHARLESTON	0	0	100	100
LONG BEACH	80	80	20	20
PUGET SOUND	25	20	75	80
MARE ISLAND	67	45	33	55
PEARL HARBOR	n.a.	n.a.	n.a.	n.a.

* not available

D. CURRENT NAVSEA GUIDELINES

NAVSEA's current guidance to shipyards dated 3 February 1988, is to have less than ten percent of material ordered for an overhaul remain unused. [Ref. 5] This goal was established by NAVSEA as a "ball park" figure to be revised after evaluating each shipyard's ability to meet this goal. Currently, NAVSEA reports the shipyards are placing from six to 15 percent of material ordered for an overhaul into their UDM accounts. Therefore, NAVSEA feels the ten percent goal is reasonable.

The author's research at Mare Island Naval Shipyard revealed the data presented in Table 3. This data covers

the last four overhauls completed by Mare Island Naval Shipyard between February 1987 and August 1989. The difference between NAVSEA's goal and data presented in Table 3 is substantial.

TABLE 3
PERCENTAGE OF MATERIAL PLACED IN UDM ACCOUNT

<u>PROJECT (a)</u>	<u>TOTAL DMI ORDERED (\$)</u>	<u>MATERIAL PLACED IN UDM (\$)</u>	<u>% ORDERED PLACED IN UDM</u>
OVERHAUL 1	14,633,261	3,862,944	26.40
OVERHAUL 2	11,476,734	2,168,254	18.89
OVERHAUL 3	13,820,743	3,112,122	22.52
OVERHAUL 4	14,543,421	3,741,179	25.72
TOTAL	\$54,474,159	\$12,884,499	AVG. 23.38%

Currently, Mare Island Naval Shipyard is receiving 19 cents per dollar of original cost when standard stock is returned to the supply system. Assuming material placed in UDM from the above four overhauls has the same composition as the entire Mare Island UDM account (67% standard material and 33% non-standard material), the NIF corpus experienced a reduction of \$8,589,666.

NAVSEA has also defined several other management tools to assist shipyard management in evaluating their inventory process. [Ref. 5] First, each shipyard will develop internal procedures to measure DMI service levels. The measure should provide a gauge to monitor performance of the

objective of having material on hand to support the industrial process.

Next, each shipyard is tasked with establishing goals for the percentage of UDM usage both by line item and dollar value. UDM usage is calculated as follows:

$$\% \text{ usage} = B/A$$

where:

A = average monthly value of UDM for the quarter;

B = value of UDM transfers to other shipyards less disposal actions and supply system turn-ins.

Finally, each shipyard will utilize a monthly UDM report that indicates current UDM balance and growth or reduction trends. Trends should be evaluated based on the workload, completed projects and the dollar value increase of the UDM account. Numerical goals are to be established based on current inventory levels and past experience. [Ref. 5:p.

20]

E. SHIPYARD MANAGEMENT INFORMATION SYSTEM

The shipyard management information system (SYMIS) has two sub-programs that assist with material management: the Material Requirements (MR) sub-program and the Material Management (MM) sub-program. A new program being implemented at all eight naval shipyards to improve unused material visibility is the Material Visibility Information

System (MVIS). MVIS will eventually become integrated into the SYMIS.

The MR sub-program is being upgraded to assist shipyard personnel in the planning phase of an overhaul. The purpose of this sub-program is to obtain historical usage data for a "typical" system which will assist the planners in establishing JML requirements for future overhauls. Currently, shipyards are able to directly transfer the material requirements identified for each job order/key-op for an existing or completed project to a pending project (thus eliminating the JML process) simply by inputting the new project number and the planner's identification code. This reduces the man-hours required for the material identification process.

Although the shipyards generally agree the new MR system will work, they feel MR will, in reality, marginally support their individual needs. Several of the shipyards have developed their own internal systems they use in lieu of the MR system.

When it is fully automated, the MR program will receive input from all eight shipyards and be able to create a "typical" system JML based on historical usage data. When the fully automated system comes on line, a planner will inspect the shipboard system to verify configuration. After the system is verified to be of the "typical" type, the planner simply inputs the project number and the planner's

identification code and requisitions will be electronically generated to procure the material necessary to overhaul the system. This system will be integrated with MM and MVIS to check the initiating yard's and all other shipyards' assets prior to creating a new procurement. Contingency material (as outlined by the technical repair standards) will be included in the list of standard material to be ordered. Special system or component configurations will still be handled with the current JML process. Implementation of the fully automated version of the MR sub-program is scheduled to be complete by the end of fiscal year 1992.

Prior to placing a new procurement order the material management (MM) sub-program of the SYMIS automatically screens the material available at that particular shipyard. Specifically, the MM system checks the current UDM account for the same national stock number (NSN) or national item identification number (NIIN) for standard material. Comparable items for non-standard material must be manually checked. Each piece of non-standard material listed in the MM system should reference technical drawings which outline very detailed material specifications and dimensions. From these drawings, it is possible to tell if the material available will fit the needs of the material required. Checking UDM accounts for non-standard material is very time consuming, tedious and often cost prohibitive unless the material is not on hand and is needed for a key event such

as undocking. Because the system is not user friendly, it is not often used.

If no items are found, the system orders the amount outlined on the JML. If material is found, it is identified by the SYMIS as being available in the UDM account and the quantity required is reduced by the number available on yard. The remaining quantity is ordered as a new procurement. If the number available in the UDM account exceeds the quantity required, all the items are identified as being available in the UDM account and no new procurement is necessary.

Although the MM sub-program of the SYMIS allows a shipyard to screen its assets prior to generating a new procurement, they are not configured to provide interyard material visibility. The Material Visibility Information System (MVIS) is a system that will make the UDM accounts, category 4 DMI, and category 5 DMI at all eight naval shipyards visible to other shipyards.

There are four major functions of MVIS:

- (1) Determine item availability,
- (2) Maintain material information,
- (3) Calculate material usage statistics, and
- (4) Display inspection code information (technical documentation).

Under the fully automated system, when a material requirement is identified by a JML, MM will first screen the initiating shipyard's assets. If the material is not found,

MVIS will automatically screen the remaining seven shipyard's UDM accounts for the material in an order predetermined by the initiating shipyard. If the desired material is not available, or cannot be released from an external shipyard, then a new procurement must be generated.

When desired material is located at an external shipyard, the material planner must contact the cognizant material manager of the holding shipyard to arrange acquisition of the needed material. This contact is necessary to:

- (1) Obtain release permission from the cognizant material manager in the case of restricted items,
- (2) Verify availability of desired quantity, physical condition, proper quality attributes, etc.,
- (3) Negotiate cost, payback requirements, etc., as appropriate, and
- (4) Arrange packaging and shipping and associated changes. [Ref. 6:p. 20]

A pilot program began in June 1988 between Mare Island Naval Shipyard and Portsmouth Naval Shipyard. Expansion of this system to include all eight shipyards in a manual mode should be complete by October 1989. A fully automated system is scheduled to be in place by September 1990.

The current expansion of the SYMIS to include excess material at all eight naval shipyards is a result of the Navy Industrial Improvement Program (NIIP). NIIP, the responsibility of the Office of the Secretary of the Navy, was founded to resolve the potential problems outlined at

Navy Industrial Fund (NIF) activities by the private accounting firm of Coopers & Lybrand in 1984 (to be discussed in detail in Chapter III of this study).

F. SUMMARY

Shipyard material is recorded in three inventory accounts: Direct Material Inventory (DMI), Shop Stores (SS) and Unassigned Direct Material (UDM). The DMI account consists of material obtained for a specific overhaul or project that is in a current status. Shop stores inventory is based on items with recurring demand or common use. UDM inventory is surplus material formally assigned to one of the other inventory accounts with a potential future use.

An integral part of inventory control/inventory management at shipyards is accomplished by the MM sub-program of the SYMIS. This program records the current assets held by the shipyard. It automatically screens these assets prior to allowing a new procurement to be issued. Similar to the MM sub-program is the Material Visibility Information System (MVIS) which will allow all naval shipyard's excess material assets to be screened prior to issuing a new procurement.

Formally recorded historical usage data are not currently available to planners. A fully automated MR sub-program will define material requirements for a "typical" system and electronically transfer these requirements to the supply department thus eliminating the JML process.

These concepts and systems are the basis for understanding the inventory philosophy exercised at naval shipyards. They are critical to understanding the inventory problems and potential solutions outlined in the remainder of this study.

III. PREVIOUS STUDIES

A. COOPERS & LYBRAND STUDY

Being squeezed by a shrinking budget and under the scrutiny of Congressional leaders, the Navy is taking a closer look at material costs at naval shipyards. In the mid-1980's, the Navy contracted with the private accounting firm of Coopers & Lybrand to conduct an impartial management analysis of the Navy Industrial Fund activities. In June 1986, they released the shipyard segment of this study. Within the shipyard segment is a chapter on inventory management/inventory control titled Materials Management.

An important point emphasized by the study is that material management does not stand alone because this subject crosses functional boundaries. It directly affects the shipyard's ability to carry out their mission: overhauling and repairing ships on time, within cost, and to the requisite quality standards. [Ref. 7:p. MM-2]

Several problems outlined by the Coopers & Lybrand study no longer exist. The author did not attempt to discern whether these changes resulted due to changes implemented in response to the study. But several of the identified problems still haunt the Navy's materials management at shipyards. The following paragraphs outline the problems

the Coopers & Lybrand study presented and the author believes still are pertinent.

The current inventory system does not track and measure the material planning process. This inadequate documentation could lead to improper repair parts ordered and possibly insufficient or surplus material. A reason the process is untracked can be attributed to its complexity. The planning, sourcing, processing and distribution functions of material management are fragmented over several organizations. Planning and Estimating (P&E) is a division within the planning department. P&E planners, shop planners, progressmen, and craftsmen often suggest different material requirements for the same job with P&E planners responsible for the final determination of material requirements. Fueling the problem is the fact that there is little or no incentive to the planners to increase the accuracy of material ordering or to reduce the inventory in the UDM account.

Contrary to NAVSEA's policy, most of the shipyards have internal policies that require all material be on hand prior to the commencement of an overhaul. Material planning driven by a single commencement date forces little attention to be paid to cost. This leads to increased inventory management costs for the following reasons:

1. Procurement and sourcing priorities become confused and meaningless because it is difficult to determine what material is actually needed first. All items have the same RDD regardless of actual required dates to support

production. As a result premium pay is spent to ensure delivery of materials that are not needed for months while items critical to production are overlooked, disrupting work in process.

2. Unnecessary costs are incurred for warehousing and maintaining inventory before they are required for production.

3. Increased staff support of procurement specialists and expediters is required to meet the artificial materials procurement workloads. This results in unnecessary, continuing indirect personnel costs. [Ref. 7:p. MM-6]

After the material requirements have been decided, the multiple handling of JML's makes their processing very labor intensive and complex. Also, it makes accountability within the system very difficult. Any attempt to associate an error to a particular segment of the process often results in finger pointing between and within departments. The lack of accountability can lead to inefficiencies in material ordering or, in the worst case, fraudulent use of the inventory system.

Once material has been received, shipyards do not have methods to accurately measure material usage during an overhaul. Furthermore, they do not have a system that measures performance in material ordered vs. material usage. This problem has been masked by a labor-intensive process which often considers material costs monetarily insignificant (material is approximately 20 percent of the total overhaul cost). Emphasizing this fact is the incorporation of material costs into the stabilized man-day rate thus reducing its visibility.

Further hampering the planners is the fact that a historical usage database does not exist. Also, material and procurement leadtimes are not adequately recorded. These two factors result in inadequate or surplus material being ordered or not being available to support the industrial process. Another repercussion is that historical usage/leadtime data cannot be shared with other shipyards.

After material is issued, material control methods are inadequate to ensure effective control of inventories. A system does not exist to track material actually being used for work in process. Because usage data includes material issued but not used, creation of a historical usage database will be inaccurate until this deficiency is corrected.

One of the results of improper documentation of prior usage is that 20 percent of the total materials ordered for the overhaul are ordered after the commencement date. This necessitates the use of personnel to expedite material in an attempt to support the industrial process. The causes of the initial oversights are: (1) improper or inadequate planning often caused by poor historical usage documentation; or (2) changes in the overhaul package by the customer. It is inevitable that some material will be ordered after the overhaul commencement due to not being able to identify deficient material until the system is opened and inspected. However, Coopers & Lybrand feel 20 percent is excessive.

Finally, Coopers & Lybrand found that shipyards as an aggregate conduct a minimal amount of joint procurement. This squanders the opportunity for shipyards to benefit from economies of scale.

B. GOVERNMENT STUDIES

GAO and the Naval Audit Service have also conducted studies concerning inventory control/inventory management at naval shipyards. Several of the problems identified by these agencies have already been discussed in the previous section. For brevity, only those deficiencies not previously covered will be discussed below.

The Naval Audit Service audit dated 8 December 1987 titled "System Visibility of Material Inventory at Naval Shipyards" was conducted at Philadelphia, Mare Island and Puget Sound Naval Shipyards. The internal control system at the audited shipyards was not adequate to prevent or detect material errors or irregularities with respect to the age of the material in category 4 DMI or UDM status. As shown in Table 4, approximately 80 percent of category 4 DMI was retained for greater than thirty days after the job order was complete. Also, one shipyard had a significant amount of material that remained in the UDM account beyond the two-year cutoff point. [Ref. 8:p. 2]

GAO began documenting inventory management problems at naval shipyards as early as 1978. [Ref. 9] As a result of that study, NAVSEA instructed the shipyards to establish

TABLE 4
MATERIAL RETENTION IN CATEGORY 4 DMI

<u>SHIPYARD</u>	<u>TOTAL SAMPLED</u>	30 DAYS OR LESS		<u>31-60 DAYS</u>	<u>61-90 DAYS</u>	<u>OVER 90 DAYS</u>	<u>% OVER 30 DAYS</u>
		<u>OR NON RFI</u>					
PHILADELPHIA	201	36		28	26	111	82
MARE ISLAND	182	62		4	4	112	66
PUGET SOUND	<u>174</u>	<u>11</u>		<u>8</u>	<u>1</u>	<u>154</u>	<u>94</u>
TOTAL	557	109		40	31	377	80

Source: Naval Audit Service Audit Report, System Visibility of Material Inventory at Naval Shipyards, 8 December 1987.

data banks to formally document historical usage. At approximately the same time, NAVSEA supplied the shipyards with an improved version of the MR sub-program to assist them with this task.

Prompted by rising inventory levels, GAO conducted another study of material management at naval shipyards in 1985. Another reason for concern was that many production supervisors attributed reduced efficiencies to material problems. [Ref. 10] The 1985 study revealed that shipyards do not effectively determine direct material requirements for future overhauls. Two reasons were outlined: historical usage information on prior overhauls is not analyzed, and complete and accurate usage data are not collected. [Ref. 11:p. 4] Analysis of this information would allow planners to minimize material shortages and

surpluses and help reduce the quantity of material ordered after an overhaul begins.

GAO believed that the lack of historical usage information and analysis contributed to the accumulation of unused material at naval shipyards. This unused material also increases costs because time and money are spent to order, store, and dispose of unneeded material. Table 5 outlines the magnitude of the surplus material problem existing at naval shipyards for overhauls completed between January 1982 and March 1984. While no specific standards exist, private shipyards, naval shipyards, and NAVSEA officials agreed that the amount of unused material associated with the industrial process of repairing or overhauling ships should not exceed five to 15 percent of ordered material. [Ref. 11:p. 7]

Recurring material shortages reduce efficiency and increase labor costs. There are two reasons material shortages reduce efficiency. First, personnel are required to manually process and expedite requisitions. Table 6 reveals the quantity of time supply department personnel at Norfolk Naval Shipyard spent expediting. Often shipyards have personnel whose sole job is expediting. Proper planning could eliminate these positions and allow time devoted by supply department personnel to expediting to be focused on their regular duties.

TABLE 5
UDM INVENTORY ACCOUNT BALANCES

<u>SHIPYARD</u>	<u>VALUE OF MATERIAL</u> (\$ in millions)		<u>% RECEIVED MATERIAL</u> <u>UNUSED</u>
	<u>RECEIVED</u>	<u>UNUSED(a)</u>	
PORPSMOUTH	67.3	29.9	44.43
NORFOLK	133.9	33.6	25.09
PHILADELPHIA	177.7	13.3	7.48
CHARLESTON	93.8	21.1	22.49
LONG BEACH	99.4	14.4(b)	14.49
PUGET SOUND	218.5	31.9	14.60
MARE ISLAND	116.5	7.9	6.78
PEARL HARBOR	<u>82.8</u>	<u>14.7</u>	<u>17.75</u>
TOTAL	989.9	166.8	16.85

(a) In some instances, the amount of unused material reported was understated because it was taken from shipyard reports prepared during the overhauls. These reports did not include unused materials which were turned in after the reports were issued. NAVSEA officials noted that amounts reported also included some duplicate items because materials not used on one overhaul could be transferred to a future overhaul and still not be used.

(b) Includes \$7 million in unused materials for the U.S.S. New Jersey. Long Beach had reported \$307,000 in its financial statement, but the Navy Auditor General stated excess materials were worth \$7 million.

Source: United States General Accounting Office Report, The Navy Can Improve Material Management at Naval Shipyards, 6 May 1985.

The second reason material shortages reduce efficiency and increase labor costs is that personnel must spend time on such activities as rescheduling work and searching for

TABLE 6

SUPPLY DEPARTMENT PERSONNEL EXPEDITING
AT NORFOLK NAVAL SHIPYARD

<u>DIVISION</u>	<u>NUMBER OF PERSONNEL EXPEDITING</u>	<u>% OF TIME SPENT EXPEDITING</u>
RECEIPT CONTROL	40	90
STOCK MANAGEMENT	6	75
PURCHASING	13	60
SHOP STORES	6	50
TECHNICAL	13	5

Source: United States General Accounting Office Report, The Navy Can Improve Material Management at Naval Shipyards, 6 May 1985.

materials. As a result of this and the expediting process, higher priority requisitions than would have otherwise been required are generated. Higher priority requisitions often require manual processing prior to processing other existing requisitions, thus slowing the overall Navy supply system response times. OPNAV Instruction 4614.1F states that no more than 50 percent of all shipyard requisitions submitted shall be categorized as high priority (Issue Group Priority I). [Ref. 1:p. 38] GAO found all eight naval shipyards to be in violation of this policy in July 1985 (see Table 7). [Ref 12:p. 21]

GAO also found that organizational goals and individual performance standards are needed. Shipyards have not been held accountable for implementing systems and procedures

TABLE 7

HIGH PRIORITY REQUISITIONS BY SHIPYARDS

<u>SHIPYARD</u>	<u>GUIDELINE</u>	<u>PERCENTAGE ASSIGNED A HIGH PRIORITY</u> <u>AUGUST 1983</u>	<u>JULY 1985</u>
PORPSMOUTH	50	51.1	75.0
NORFOLK	50	72.4	79.6
PHILADELPHIA	50	71.7	56.6
CHARLESTON	50	66.5	55.5
LONG BEACH	50	81.2	65.4
PUGET SOUND	50	(a)	54.5
MARE ISLAND	50	79.3	63.8
PEARL HARBOR	50	(a)	57.9

(a) Did not exceed guideline

Source: United States General Accounting Office Report, Intermediate Inventories Can Be Reduced, October 1986.

provided by NAVSEA which were designed to improve materials management. Because the shipyard personnel performance evaluation system does not hold material management personnel accountable for meeting outlined standards and goals, shipyards have been ineffective in implementing prescribed procedures designed to improve material management efficiency.

C. SUMMARY

Studies began outlining problems in inventory management at naval shipyards 11 years ago. Inadequate documentation

of historical usage data is the root cause of several identified deficiencies. Material shortages result due to incomplete documentation. This leads to reduced efficiency and increased labor costs because people are required to expedite material often resulting in a higher than originally needed priority on material requisitions. Most shipyards have attempted to correct the problem of inadequate material to support the industrial process by mandating all material be on hand prior to overhaul commencement. This increases the carrying costs of inventories. Shipyards also squander a potential cost reduction by not engaging in joint procurements.

Organizational goals and performance standards are needed to specifically outline a shipyard's policy concerning materials management. Once the goals are established and all material management personnel are familiar with them, an aggressive attempt to meet the goals should be pursued. Also, an internal control system must be developed to ensure the outlined standards are followed. The financial impact of these problems is significant. Material management needs to be placed high on all shipyards' lists of priorities.

IV. DISCUSSION AND ANALYSIS

A. DIRECT MATERIAL INVENTORY

As noted in Chapter III, the root cause of escalating inventories at naval shipyards can be traced to not correctly identifying material requirements. Deficiencies within this identification process lead to wide variations in quantity of material ordered for similar projects. These deficiencies include: (1) inadequate communication between the planners and shops performing the work; (2) inadequate documentation and recording of historical usage data; and (3) lack of accountability within the performance evaluation of planners.

Extensive communication between the shops and planners is necessary so that feedback from the personnel actually performing the work can be used by the planners to identify potential material shortages or surpluses. A current project at Mare Island Naval Shipyard has progressed much smoother than previous projects with unused material being estimated far below their previous values. The success of this project is being largely attributed to better communication between planners and the shops. Without an historical usage database (the current situation) and feedback, the planner can only base the quantity of material

ordered on personal observations, prior experience, and the experience of his/her fellow planners.

Many of the problems associated with surplus material result because of inaccurate or inadequate documentation of historical usage. Another important point is an accurate historical usage database will also result in less material shortages. This means less work stoppages because the craftsmen lack material. Also, less time and hence money will be spent on expediting material through the supply system after the overhaul commences. Currently personal information is what is used to make judgments on how much material to order. Hopefully this method will only last for a short period until the automated process of material requirements identification associated with the MR sub-program is introduced.

To ensure usage data is accurate for initially establishing a database and for updating the database, shipyards must aggressively pursue a policy of minimizing bench spares maintained by shops. Shops at Mare Island take all the material for a job order into their custody. Shop planners are responsible for issuing the material to support work. They are also responsible to ensure material issued but not used is returned to the supply system. Management and workers both feel the administrative process associated with turning-in unused parts is too time consuming. They feel the process must be streamlined before it can be

effectively used. Controlling unused material ensures the historical usage database reflects material actually used and not material issued.

Although the performance evaluation system for planners varies from shipyard to shipyard, as a whole very little emphasis is placed on the material identification process. Only a small portion of the planner's time is expended on identifying material requirements and completing JML's. Because of this fact, only a small portion of their evaluation is based on successful material requirements identification. In fact, most shipyards use the number of material shortages as their yardstick for measuring a planner's performance with respect to material identification. This naturally causes the ordering of surplus material and hence the UDM account grows.

B. UNASSIGNED DIRECT MATERIAL

UDM accounts at naval shipyards continue to increase. In 1985, UDM accounts at all eight naval shipyards totaled \$50.4 million. [Ref. 11] As of their June 1989 financial statements, the current UDM total at naval shipyards is \$145.63 million. This is a 189 percent increase or a 47.25 percent increase per year.

The management tools outlined by NAVSEA to prevent a further increase in the UDM inventory are not being fully utilized by naval shipyards. Furthermore, many people the author interviewed who are involved in the planning process

did not know these guidelines existed or where their shipyard was with respect to establishing or using them.

As shown by Table 3, the goal of limiting the inventory in UDM to no more than ten percent of all DMI ordered for an overhaul into UDM is not being achieved.

Another management tool outlined by NAVSEA but unused by naval shipyards is percent usage statistics. These statistics provide a shipyard with information concerning the percentage of their UDM accounts that is transferred to other shipyards during the period of the report. Because this program is in its infant stages, NAVSEA has not yet established goals with respect to percent usage. Although shipyard management cannot directly affect these values (they are driven by the remaining seven shipyards' demands for material they hold), low usage could mean it is not cost effective to carry material past the two-year limit set by NAVSEA. This two-year limit is set by the Office of the Comptroller and is outlined in Reference 3 (The Navy Comptroller Manual).

Currently, shipyards carry material in UDM longer than two years. There are several reasons for this. First, the small amount of money received for turning standard stock items into the supply system often discourages turning the material in, particularly for high dollar value items. The dollar value received for unused material is very low because NAVSUP has adopted a policy of zero money being paid

for turned-in items unless an outstanding demand exists. Non-standard material has no turn-in value with the exception of what the shipyard can receive from the material as scrap.

Prior to excessing material, the shipyard must weigh the cost of storing and managing the material against the probability a demand will arise for the item and they will be able to recover their entire investment. The costs of maintaining material in inventory include:

- (1) Cost of taking physical inventories;
- (2) Cost of maintaining inventory records;
- (3) Cost of shelf life surveys;
- (4) The differential between costs of commercial storage sites or commercial versus government-owned storage sites, if applicable;
- (5) Other additional costs, if any. [Ref. 13:p. 3]

An example of retaining material occurred at Long Beach Naval Shipyard. Table 1 showed that Long Beach's UDM account was at approximately \$32 million in June 1989. This account balance was large because for several years, Long Beach maintained a policy of not excessing standard stock in hope that a demand would arise and they could recover their entire investment. They have recently changed this policy and have a goal of excessing \$2 million of material each month until all the material in the UDM account meets the two-year recency requirement. Their UDM account balance in November 1989 was \$22,190,686.

In order for Long Beach to excess material in the above example, their NIF corpus had to absorb the financial loss associated with receiving far less money for the material than they originally paid. This loss was created because the shipyard does not receive reimbursement for material placed in the UDM account. Therefore, the corpus is replenished (by the customer when the job is complete) at a lesser value than the material purchased.

In private industry this cost of surplus material would be passed onto the customer through higher rates to perform the work or the company would just receive less profit. NIF activities are non-profit units and only charge the customer for material and labor used to complete the project.

Overhead is also factored into the stabilized man-day rate. This overhead rate is affected by UDM because the maintenance, manning and upkeep of the warehouses the material is stored in is part of shipyard overhead.

The unwillingness of the shipyard's comptroller's office to have the NIF corpus absorb the financial loss associated with excessing material from the UDM account often forces shipyards to carry the material longer than two years.

Recently (October 1989), NAVSEA directed SPCC to check their outstanding orders against the UDM accounts at all eight naval shipyards. This action found that 500 line items back-ordered at SPCC were available in naval shipyard UDM accounts. The dollar value savings was \$3 million.

This process, performed periodically and coupled with the MVIS program, could help reduce the UDM inventory growth problem currently confronting naval shipyards.

C. SHIPYARD MANAGEMENT INFORMATION SYSTEM

Probably the most critical step in reducing the UDM inventory account involves the SYMIS. The development of an historical usage database by the MR sub-program should significantly reduce the surplus material placed in the UDM account. This is because more accurate identification of material requirements will result in less surpluses and shortages of material.

The automated MR sub-program was originally scheduled to be available to shipyards by September 1989. This delivery date has slipped to the end of fiscal year 1992. The delay for full implementation of an automated MR sub-program is funding related. The problem is all programs must have a definite benefit in order to warrant expenditures. But cost-benefit studies on management information systems are very marginal at best. This is because the benefits are not easily quantified and are often over long periods of time (as is the case with the MR sub-program). The costs, on the other hand, are easily identified and often are very large up-front.

The MVIS program attacks the UDM problem from a different perspective. Whereas the MR sub-program will help solve the root cause of UDM growth, MVIS attacks material

that is already surplus by increasing its visibility. This program is a very positive step in the correct direction to reduce UDM inventory.

D. SUMMARY

The root cause of growing UDM accounts at naval shipyards evolves from the material planning phase of the ship overhaul process and the reduced visibility of material once it is designated as surplus. Specifically, inaccurate identification of material requirements naturally lead to surpluses which swell the UDM account. Furthermore, planners are only held accountable to ensure no shortages occur. They are not evaluated based on goals outlined by NAVSEA.

Once material is placed in the UDM account, management tools are not used to monitor UDM inventory. Material is held longer than the time limit because of shipyards' unwillingness to accept a financial loss in hope of recovering their full investment.

The SYMIS could have a major impact on the reduction of the UDM account. A swift development of the MR sub-program, which would establish a historical usage database, would correct the most glaring problem causing UDM account growth. This coupled with the positive steps being taken to increase UDM account visibility could significantly reduce UDM account balances.

V. SUMMARY AND RECOMMENDATIONS

A. SUMMARY

Because the reduction in real dollars allocated to the Defense budget over the last five years is projected to continue well into the 1990's, it is critical for naval shipyards to better manage their inventories. This study examined the inventory process at naval shipyards with emphasis on the creation and disposal of unassigned direct material.

The primary mission of the eight naval shipyards is to overhaul naval vessels. Emphasis is placed on accomplishing this task within a predetermined amount of time agreed upon by the shipyard conducting the overhaul and NAVSEA. Shipyards are also expected to complete this work within a predetermined budget. Because the overhaul process is very labor intensive, the primary focus is on production control. Inventory control and, consequently, inventory costs are often regarded as monetarily insignificant.

Inventory control/inventory management for ship overhauls begins with the planning phase. During this period, material requirements are identified and material is ordered. Accurate and timely material identification directly effects two of the three missions Mare Island Naval Shipyard has outlined it shall strive to achieve: complete

all projects on time and complete all projects within budget. Once the material is received, it becomes part of a particular project's DMI. Material is drawn from this account throughout the overhaul to support the industrial process.

Upon completion of job orders or 60 days after the overhaul is complete, all unused material must be disposed of, transferred to an existing project or sent to the UDM account. The UDM inventory is material which the shipyard believes will have a future (within two years) demand. Excessing material from the UDM account is accomplished when the shipyard foresees no future demand.

The funding to accomplish work at naval shipyards is provided by the Navy Industrial Fund. It is essentially a working capital account (called the corpus) which works on a revolving basis. The outlays are to purchase material, pay wages, and maintain facilities. If material is placed in the UDM account and eventually excessed at a price less than what the shipyard paid, this action serves to reduce the NIF corpus. This results in additional funds being needed by the shipyards from the Navy's budget.

B. RECOMMENDATIONS

The author believes the brunt of the emphasis necessary to solve the problem of growing UDM inventories needs to be focused on the planning phase and the correct identification of material requirements. This is not being done at present

and, coupled with the reduced visibility of material in the UDM account, is the root cause of increasing UDM accounts. Extensive communication between the planners and the end users of the material, shops performing the work, is critical to accurately document and identify material requirements. Shop planners must be held accountable for the accumulation of bench spares. Unused material that is not returned to the supply system results in inaccurate overhaul usage statistics which will result in the same quantity being ordered for the next overhaul.

A critical input the planner currently lacks to perform a good material requirements analysis is accurate historical usage data. The creation and use of a historical usage database from the MR sub-program of the SYMIS should solve this problem. Once an automated MR sub-program is established, integration of the SYMIS will reduce the data redundancy and duplicate work currently generated by planners. Establishing an historical usage database as quickly as possible should be number one on naval shipyards' list of priorities. This single action will have a far greater impact than any other recommendations on reducing the UDM account growth.

An additional enhancement to the MR sub-program would be the identification of contingency material requirements. Currently, contingency material requirements are outlined by the Automated Material Requirements List (AMRL) for only

about 20 percent of systems repaired during an overhaul (mission critical items).

After material requirements have been identified, shipyards often squander the opportunity of quantity discounts. Joint procurements by shipyards should be analyzed for their cost effectiveness.

The next step should be to modify the planner's performance evaluations to reflect the timeliness and accuracy of their material requirements identification process. Material requirements identification is far more important than the portion the current planners evaluation system gives to it.

GAO recommended setting goals for the planners in the following areas:

- (1) Percentage of material ordered after overhaul commencement; and
- (2) Percentage of unused direct materials after each overhaul.

Once these goals are set and adequate experience is gained in using them, GAO and the author recommend that NAVSEA should require that shipyards include appropriate standards in the performance appraisals of those employees responsible for material management activities and hold them accountable for meeting these standards. [Ref. 11:p. iv]

If necessary, personnel could specialize in material requirements identification to relieve them of other duties associated with being a planner. This would eliminate the

problem of how to weigh each of the tasks performed by planners on their performance evaluations. Also it would facilitate accountability for material shortages and surpluses.

Additional inputs for management to evaluate the performance of the materials process at naval shipyards that are currently only marginally used have been outlined by NAVSEA. These include:

- (1) A long term goal of having less than ten percent of direct material ordered for overhaul remain unused at overhaul completion;
- (2) Percent usage statistics calculated and distributed to inform management how successful the shipyard currently is with respect to disposing of UDM to other shipyards or supply activities; and
- (3) Disbursement of monthly UDM reports emphasizing growth or reduction trends.

Once material is placed in the UDM accounts, its usage will be dependent on its visibility. This visibility must be increased. The MVIS program currently being implemented is a very positive step in that direction. Another method of making shipyards' UDM accounts visible is to require SPCC to check the UDM accounts every time they get another set of planned requirements from NAVSEA. Comparing UDM accounts with outstanding orders at SPCC, done in October 1989, resulted in a reduction of UDM accounts of approximately \$3 million. The author recommends that incorporating the UDM accounts into the planned program requirements process be evaluated for feasibility as soon as possible. This action

coupled with the MVIS program could reduce the current UDM inventory accounts.

C. FUTURE RESEARCH

There are several areas of future research that naval shipyards and NAVSEA could benefit from. An area that continues to be debated is, can shipyards afford stock-outs and for how long? An analysis of the cost (due to idle labor and resources) of stocking only a percentage of the material versus the benefit (due to zero stock-outs) of stocking all the material possibly expected to be needed could be beneficial to ensure the most economical path is taken. Improved supply support from a local stock point may be the best answer.

Further studies should also be conducted to ensure the MVIS program currently being implemented is providing the necessary visibility to the UDM accounts to reduce their balances. Also, once the MR sub-program upgrade is implemented it should be evaluated to ensure the historical usage database that is critically needed by planners is easy to use and provides accurate material requirements.

Finally, after the above recommendations have been implemented, a follow-on study should be conducted to evaluate their effectiveness and make additional recommendations on how to further reduce the UDM accounts balances.

APPENDIX

LIST OF ACRONYMS

APL	Allowance Parts List
COAR	Customer Order Acceptance Record
DMI	Direct Material Inventory
JML	Job Material List
Key-op	Key Operation
MM	Material Management sub-program
MR	Material Requirements sub-program
MVIS	Material Visibility Information System
NIF	Navy Industrial Fund
NIIN	National Item Identification Number
NIIP	Navy Industrial Improvement Program
NSN	National Stock Number
RDD	Required Delivery Date
SS	Shop Stores
SYMIS	Shipyard Management Information System
TRS	Technical Repair Standard
UDM	Unassigned Direct Material

LIST OF REFERENCES

1. Souther, Rory L., Evaluation of Inventory Management Policies at Naval Shipyards, Master's Thesis, Naval Postgraduate School, Monterey, California, June 1988.
2. Department of the Navy, Office of the Comptroller, Introduction to the Navy Industrial Fund, January 1989.
3. Department of the Navy, Office of the Comptroller, Navy Comptroller Manual: Navy and Marine Corps Industrial Funds.
4. Commander Naval Sea Systems Command Instruction 7600.27, The Navy Industrial Fund Financial Management Systems and Procedures Manual.
5. Commander Naval Sea Systems Command letter 4400 ser 07/09 dated 3 February 1988, Shipyard Material Policies.
6. American Management Systems, Inc./Booz-Allen and Hamilton, Inc./MERIT Systems, Inc., Sourcing and Accessing Procedures for Short Term Material Visibility, Navy Industrial Improvement Program (NIIP) UDM Visibility, 39 July 1988.
7. Coopers & Lybrand, Management Analysis of the Navy Industrial Fund Program, Shipyard Review Report, June 1986.
8. Naval Audit Service Audit Report, System Visibility of Materials Inventory at Naval Shipyards, dated 8 December 1987.
9. U.S. General Accounting Office Report, Naval Shipyards-- Better Definition of Mobilization Requirements and Improved Peacetime Operations are Needed, 31 March 1978.
10. U.S. General Accounting Office Report to the Secretary of the Navy, Navy Can Improve Management of Shipyard Labor Resources Through Better Work Measurement Practices, 24 April 1984.
11. U.S. General Accounting Office Report to the Secretary of the Navy, The Navy Can Improve Material Management at Naval Shipyards, 6 May 1985.

12. U.S. General Accounting Office Report to the Secretary of the Navy, Intermediate Inventories Can Be Reduced, October 1986.
13. U.S. Department of Defense Instruction 4140.49, Movement of Stocks From Attrition Sites, 17 March 1981.

BIBLIOGRAPHY

American Management Systems, Inc., Inventory and Material Management: Material Roll-Out Guide for Future Shipyards, 9 December 1988.

American Management Systems, Inc., Report of Programs and Procedures to Statify the NSY Inventory, 7 June 1988.

American Management Systems, Inc./Booz-Allen & Hamilton, Inc./MERIT Systems, Inc., Financial Monitoring and Control at Mare Island Naval Shipyard, 7 November 1988.

Eckstein, Eric Rockhill, Schedule Adherence in a Naval Shipyard--A Case Study, Master's Thesis, Naval Postgraduate School, Monterey, California, September 1976.

Plossl, George W. and Welch, W. Evert, The Role of Top Management in the Control of Inventory, Reston Publishing Company, Inc. 1979.

Ronen, Boaz and Trietsch, Dan, "Optimal Scheduling of Purchasing Orders for Large Projects," Research Paper, Naval Postgraduate School, Monterey, California, June 1987.

Vanston, Myles Garrett, Analysis of the Submarine Redistribution and Temporary Storage (SUBRATS) Program, Master's Thesis, Naval Postgraduate School, Monterey, California, June 1989.

INITIAL DISTRIBUTION LIST

	No. Copies
1. Defense Technical Information Center Cameron Station Alexandria, Virginia 22304-6145	2
2. Library, Code 0142 Naval Postgraduate School Monterey, California 93943-5002	2
3. Professor Alan W. McMasters, Code 54Mg Department of Administrative Sciences Naval Postgraduate School Monterey, California 93943-5000	1
4. CDR Glenn Eberling, Code 54Er Department of Administrative Sciences Naval Postgraduate School Monterey, California 93943-5000	1
5. Material Officer, Code 560 Mare Island Naval Shipyard Vallejo, California 94592	1
6. Accounting Division Head, Code 630 Mare Island Naval Shipyard Vallejo, California 94592	1
7. LT Mark D. Rohrbach 312 Portsmouth Road Cherry Hill, New Jersey 08034	2

Thesis
R6873 Rohrbach
c.1 An analysis of unassigned direct material at naval shipyards.

Thesis
R6873 Rohrbach
c.1 An analysis of unassigned direct material at naval shipyards.



An analysis of unassigned direct materia



3 2768 000 88757 4
DUDLEY KNOX LIBRARY